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User Manual
DE-ICING BOX
Accessory for SOLPLUS Inverters

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1 Introductory remarks

The DE-ICING BOX is an accessory specifically designed for the SOLPLUS 25 – 55 inverters manufactured by Solutronic Energy. It is only suitable for use with these inverters. This document is a supplement to the User Manual for SOLPLUS inverters. Please read and observe the safety information and danger notices contained in that manual. A complete version of the User Manual for the inverters can be found on the CD supplied with each inverter. A printed version (hardcopy) of the complete Installation Instructions is supplied with each SOLPLUS inverter.
Please comply with all instructions and information of relevance to and essential when handling pieces of technical equipment.

2 Symbols used

Please read and observe the following safety instructions in this manual.

The danger classes describe the risks of non-observance of the safety instructions.
(The safety instructions describe the following danger classes per ANSI.)

	Caution!
"Caution!" denotes a warning that, if not observed, can result in personal injury!	

	Note
Nützliche Informationen und Hinweise für den optimalen Betrieb des SOLPLUS Wechselrichters.	

	Warning!
"Warning!" denotes a warning that, if not observed, can result in death or serious injury!	

3 How it works

The DE-ICING box is suitable for all SOLPLUS 25 - 55 inverters, which have been produced after the calendar week 20 in 2007. Inverters which have been produced before this date, have to be updated by Solutronic.

The de-icing function is only suitable for crystalline PV modules whose open-circuit voltage is less than 750 V at -10°C, because otherwise the full heating performance will not be obtained. The reason for this is that the maximum possible DC heating voltage is 835 V and the PV modules require a higher voltage in feedback mode.

SOLPLUS 25, 35, 50 and 55 inverters from Solutronic facilitate a de-icing function in feedback mode that makes it possible to heat the modules. This enables snow that falls or ice that forms on the modules to be thawed and to slide off.
Whether this results in complete de-icing of the modules depends not least on the design (e.g. pitch) of the roof, how the modules are installed, the ambient temperature, etc.

It is expected that the modules can be heated to about 10 ° C.
DE-ICING operation may only be started manually and not automated.

Recommendation

Roof pitch: To facilitate effective functioning of the DE-ICING BOX, we recommend a roof pitch of 25 degrees or more.

Roof area: Prerequisite for use of the DE-ICING BOX is that the area below the solar modules is free of obstructions so that the snow can slide off unhindered.

Safety: Owing to the fact that the DE-ICING BOX, when in use, leads to snow sliding off the PV modules and the roof, safety is a top priority in the area below the edge of the roof. We recommend you fence off the danger area in some manner.

Always switch the DE-ICING BOX off when it is not required: Owing to the way it operates, a DE-ICING BOX that is switched on consumes up to 50 W of power (depending on your PV generator) if the inverter has not yet been switched to de-icing mode. Its typical power consumption is less than 10 W, and under 0.5 W when switched off.

The de-icing function can only properly fulfil its purpose if its use is carefully thought through and planned. For this reason, keep a log (especially during the first winter period) of when and how you use it and the results achieved (see chapter 7).

3.1 Safety information relating to the DE-ICING BOX

Please read the following safety information and instructions before you put the system into operation for the first time, in order to avoid personal injuries and/or property damage. These instructions must be complied with at all times.
Do to attempt to install or put this device into service until you have read through all the documentation supplied thoroughly. Read through these safety instructions and all other user instructions and tips before you begin work with this device.
If you sell on, hire out or pass on this device to someone else in some other way, make sure that you give the new user these safety instructions, too.
Intended use: This device must be used only for the purpose described in this User Manual.
All safety regulations must be complied with. All installation work must be carried out precisely as described in this manual.
No modification of any kind to or in this device or to its external wiring is permitted. Any such modification could lead to serious safety problems and danger to life and limb.

	Caution!
The surface of the device housing may be hot! Risk of injury! Very hot! Do not touch!	

	Warning!
High voltage due to incorrect connection! Risk of fatal or bodily injury from electric shock.	

	Warning!
Improper use of these devices, non-observance of the warnings given in this manual and improper tampering with the safety functions can lead to property damage, personal injury, electric shock and, in extreme cases, death.	

General information

Solutronic Energy shall accept no liability for damages resulting from non-observance of the warnings given in this User Manual.

Read the operating, maintenance and safety instructions before you put the device into operation for the first time. If you are not able to understand the language used in this documentation sufficiently, please contact and inform the supplier of the situation.

Trouble-free and safe operation of this device presumes proper, professional and workmanlike transportation, storage, mounting and installation as well as careful operation and thorough maintenance.

Always deploy trained and qualified personnel to work with and on electrical equipment.

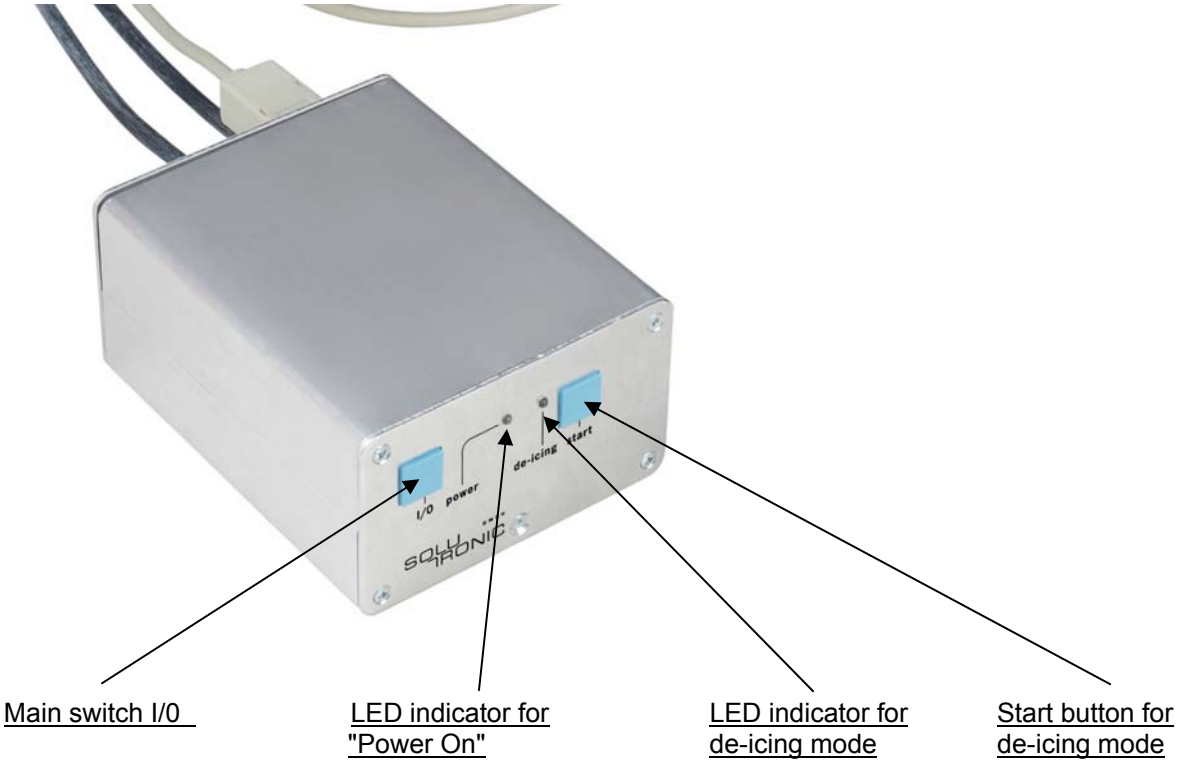
Only appropriately trained and qualified personnel is allowed to work on this device or in its vicinity. Such personnel can be deemed appropriately qualified if they are adequately familiar with the mounting, installation and operation of the product as well as with all warnings and precautionary measures as stated in this User Manual.

The ambient conditions specified in the product documentation must be complied with.

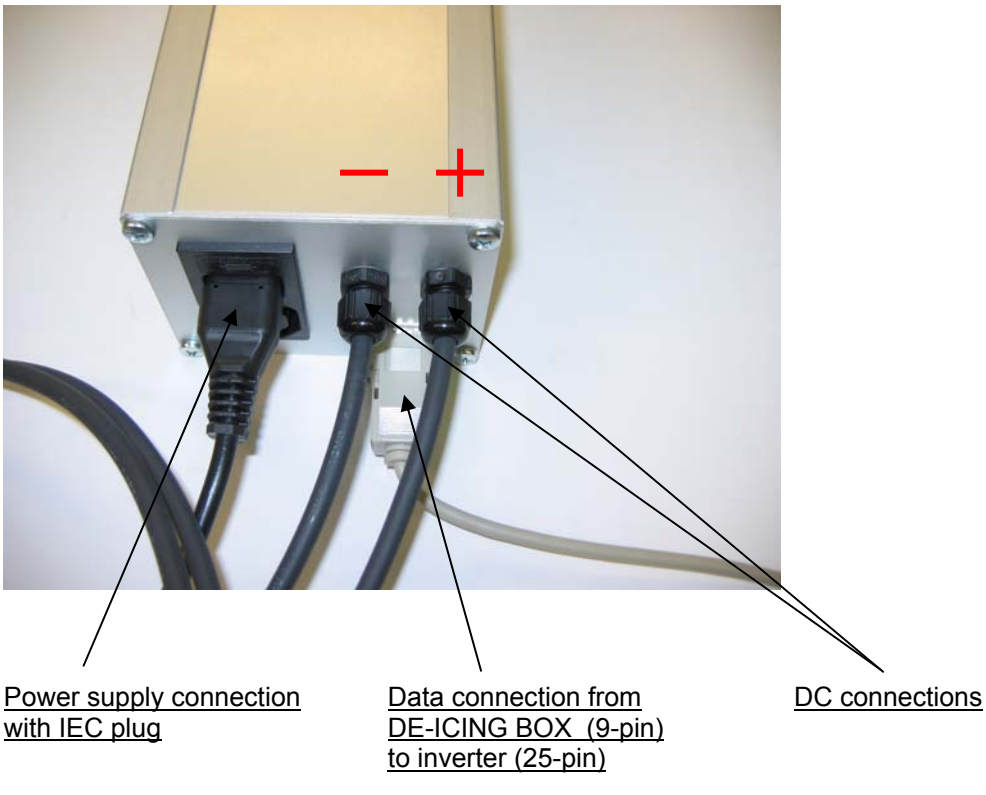
Please read and observe the following danger notices contained in this manual

4 Design of the DE-ICING BOX

DE-ICING BOX (front view)



DE-ICING BOX (rear view)



5 Mounting the DE-ICING BOX

All connecting cables between the DE-ICING BOX and the SOLPLUS inverter are approx. 2 m long.

Mounting location:

- Dry location
- Close to the inverter
- Make sure that circulation of air around the device is not impeded.

→ A minimum clearance of 20 cm in all directions (from top, bottom and sides) must be kept from the inverter

6 Electrical Connection of the DE-ICING BOX

6.1 Setup of the data connection

Use the data cable supplied with the DE-ICING BOX to make a connection between the SOLPLUS inverter (plug connection X4, 25-pin Sub-D socket on left-hand side) and the DE-ICING BOX (plug connection X1, 9-pin Sub-D connector).

6.2 Connecting the DC connections between the DE-ICING BOX and inverter

Preliminary remarks: If there is no DC string available on the inverter for connecting the DE-ICING BOX, you will have to use standard commercially available Y joints (available for every type of DC plug connector).

Note: If you cut and terminate the cable yourself, please take great care to ensure the polarity of the strands is correct. The positive (+) connection of the DE-ICING BOX is at the top right of the box, above the 9-pin Sub-D socket (see Fig. 2). Connect the positive connection of the DE-ICING BOX to the positive connection of the inverter. Likewise, connect the negative (-) connection of the DE-ICING BOX to the negative connection of the inverter.

6.3 Connecting the DE-ICING BOX to the power supply

Now connect the DE-ICING BOX to a power socket with earthing contact using the IEC power cable supplied with the device.

Finish off by running all cables with care. Do not leave any loose cables hanging down!

7 Setting the De-icing Functions at the Inverter

Note: All functions can be accessed and set with the aid of the final customer password (password level 1).
Button combination: ▲►▼▲►▼ and complete by pressing [OK].
Further information with regard to controlling the inverter display can be found in the User Manual for SOLPLUS inverters.

Requirements: Inverter firmware: Version 1.2.25 or higher. If it is not installed, carry out a firmware update.
You can show the firmware version by pressing any button on the display. The firmware version will be displayed for a few seconds. (The firmware version can also be found under the main menu item "Inverter".)

All parameters required for operating the DE-ICING BOX can be found under the main menu item "Options" (password must be entered first). The following parameters must be set to enable the de-icing function to be activated (started) at all:

7.1 Duration of heating period

Parameter 285:	**Heating period time**
Menu:	Options
Unit:	Minutes
Default setting:	60 minutes
Password level:	Customer

→ Leave the factory setting unchanged for the first time you use the heating/thawing function.

7.2 Setting the heating current

Parameter 286:	**Heating current factor**
Menu:	Options
Unit:	%
Default setting:	80%
Password level:	Customer

Leave the factory setting unchanged for the first time you use the heating/thawing function.

7.3 Nominal output of your PV generator

Parameter 272:	**Nominal DC generator output**
Menu:	Monitoring
Unit:	W
Default setting:	0 W
Password level:	Customer

You have to enter the nominal output of the PV generator.

	Note
Even if incorrectly programmed, the maximum output of the inverter used is never exceeded: the output of SOLPLUS 25 inverters in de-icing mode is limited to 2500 W, that of SOLPLUS 35 inverters to 3500 W, SOLPLUS 50 to 5000 W and SOLPLUS 55 inverters to 5500 W. Despite this, it is important that the value is correct, because it is used to calculate the wattage set under parameter 286.	

7.4 Maximum DC heating voltage

Parameter 287:	**Maximum heating voltage**
Menu:	Options
Unit:	V
Default setting:	600 V
Password level:	Customer

Setting: Open circuit voltage (at -10 ° C) of connected modules +10% of this value.

7.5 Heating configuration

Parameter 288:	**Heating configuration**
Menu:	Options
Unit:	none
Default setting:	0
Password level:	Customer

This parameter enables the de-icing function to be started. To enable, set to 1.

7.6 Explanation of the de-icing function settings

Duration of heating period

The typical heating/thawing period ranges from around 15 minutes (at mild temperatures, with wet/sticky snow or when the pitch of the roof is steep and the snow slides off quickly) to 2 hours (when temperatures are very low, the pitch of the roof relatively flat or the snow coverage thick).
When using the function for the first time, please begin with a heating period of 60 minutes and watch whether and how quickly the heating/thawing process progresses.

Heating current/nominal output

These two parameters define the actual performance level at which the de-icing function is started.

Example:
SOLPLUS 50 inverter
Nominal generator output: 5500 W
Target: heating/thawing is to be conducted at 75% of this nominal output → nominal output of 4100 W

Configuration required:
Parameter 286 Heating current factor: Setting = 75
Parameter 272 Nominal DC generator output: Setting = 5500

Maximum voltage

Parameter 287 should be set to a value approx. 10% higher than the open-circuit voltage of your PV generator.
Note: This means the DC voltage supplied by the inverter in de-icing mode will not exceed the value set here. If during de-icing you find that the level of heating you want is not being achieved, please check this parameter and increase the setting.

8 Option: Connecting Another Source of Mains Current

The inverter gets the energy required for the de-icing function from the feed point from the PV modules. For this reason, you must make sure that you install a 2-way meter at the feed point if you intend installing a DE-ICING BOX.
The inverter can, however, also be supplied with power from another source of mains current during de-icing. The functions of relay 1 (selector switch) and relay 2 (circuit closer) control connection of this other source via the contacts of the 8-pin terminal strip (X5).

Please observe the information and instructions in the User Manual on connecting this power source and contact loading!

8.1 Configuring option relay 1

Parameter 46:	**Function of relay 1**
Menu:	Options
Unit:	-
Default setting:	1
Password level:	Customer

Set to 11: relay 1 is tripped during de-icing mode.

8.2 Configuring option relay 2

Parameter 47:	**Function of relay 2**
Menu:	Options
Unit:	-
Default setting:	0
Password level:	Customer

Set to 11: relay 2 is tripped during de-icing mode.

9 Starting the De-icing Function

Preliminary remarks: The de-icing function can be started (activated) at any time of the day, day or night. However, when operating the DE-ICING BOX during the day, you must take into account the fact that the inverter no longer feeds electricity into the grid while the de-icing function is activated. This means that the DE-ICING BOX has to be started differently depending on whether it is to operate during the day or night.
Activation (starting) and deactivation of the de-icing function are both indicated by a short 'beep'.
DE-ICING operation may only be started manually and not automated.

9.1 Switching on the DE-ICING BOX an the I/0 button (main switch)

The DE-ICING BOX is only required to start or stop manual operation of the DE-ICING operation. It is therefore useful to take the I / 0 button (main switch) only to start or stop manually the DE-ICING BOX operation.

Press and hold the I/0 button (main switch) for 1 second and then wait 10 seconds until the "Power" LED lights up.
The "Power" LED must now be on. In the case of night-time use, the inverter's display switches on a few seconds after you switch on the DE-ICING BOX. The display first shows the Start menu, then the basic (start) screen.
During grid-feed operation or if UDC is >330 V, there is no change in what is shown on the display.

9.2 Starting the de-icing function

At daytime: 10 – 15 seconds
At night-time: 3 – 6 seconds
"Starting DE-ICING" appears on the inverter's display. The "DE-ICING" LED on the DE-ICING BOX comes on and you can hear a short 'beep' from the inverter.
Shortly afterwards, the display switches to "DE-ICING", the grid relays close and the DC voltage and power slowly rise.
The inverter will now heat your PV generator for the length of heating period you have set and switch itself off again automatically at the end of this period.

9.3 Stopping the de-icing function

To stop (deactivate) the de-icing function manually, press and hold the Start button for 3 seconds.

9.4 Switching off the DE-ICING BOX an the I/0 button

The I/0 button (main switch) is only required for switching on the DE-ICING BOX to enable you to start the de-icing function or to stop the function manually.

10 Monitoring and Logging the Results

	Note
The de-icing function can only properly fulfil its purpose if its use is carefully thought through and planned.	

When using the de-icing function for the first time, make sure that the level of heating you want is achieved. You can use the display on the inverter to monitor this. If you experience problems with this function, check the "Heating period time", "Heating current factor" and "Maximum heating voltage" parameters (parameters 285 – 287) in the inverter's "Options" menu (see chapter 5).

Our recommendation as regards usage

We recommend that you use the de-icing function only when a "spell of good weather" is expected that will enable your PV system to generate electricity and feed it into the grid.
There is no point in using the de-icing function every day, possibly even for hours at a time, during a spell of bad weather. You could well find that you consume more energy keeping the generator clear than the snow-free generator is actually able to generate on the next snow-free day.
It goes without saying that it is extremely difficult to make any sort of definitive statement with respect to the amount of energy used and the potential additional amount gained.

The following parameters are provided to allow you to monitor the energy consumption and "thawing performance" of the DE-ICING BOX:

Parameter 227: DE-ICING energy today

Menu: Options
Unit: kWh
Resolution: 0.001 kWh

This parameter indicates the amount of energy consumed by the de-icing function during the current day or night (today).

	Note
Parameter 8 "Energy today" (which measures the amount of energy fed into the grid 'today') and the value provided by the annual energy logger are not affected by the de-icing function.	

Parameter 229: DE-ICING energy total

Menu: Options
Unit: kWh
Resolution: 1 kWh

This parameter indicates the total amount of energy consumed by the de-icing function since start-up.

	Note
Parameter 12 "Energy total", which measures the total amount of energy fed into the grid, is not affected by the de-icing function.	

Our tip
During the first winter at least with the DE-ICING BOX, you should keep a precise log of the circumstances/conditions under which you use the de-icing function and of the amounts of generator- and grid-sourced energy consumed.
If you have 2 or more PV generators and 2 or more inverters connected to your PV installation, we recommend that you use the de-icing function in conjunction with just one of the inverters, at least during the "learning phase". This will enable you to use the inverter not used for de-icing as a control.
To help you keep such a log, we have prepared a table you can use. More information can be found on our website. If you would like even more detailed information and assistance, please talk to our service team.
We and our dealers would be extremely interested in receiving meaningful, firsthand reports from you, our users!

11 Warranty

There are absolutely no technical reasons why PV modules should not be used in feedback mode, because the load to which they are subjected is no different from that that arises during normal daytime operation when they feed into the grid.
Some manufacturers already permit heating/thawing of their modules in this way without any restrictions. Other manufacturers have not yet issued such consent because they have not yet got round to investigating this matter.
If you receive a negative response from the manufacturer of your modules, please ask for the exact technical reasons. If many cases, manufacturers cite "safety reasons" for why they are not prepared to give their consent, the real reason, however, being that they have so far never had cause to think about de-icing modules. In such cases, draw the manufacturer's attention to the existing standard already in force that stipulates the testing of modules in feedback mode as a binding criterion for certification.

	Note
The de-icing function can not be used with thin-film modules due to the inadequate amount of heat that would be generated and the large surface area of the modules (lower efficiency). Furthermore, the de-icing function can not be used in conjunction with series diodes. SOLPLUS 25, SOLPLUS 35, SOLPLUS 50 and SOLPLUS 55 inverters from Solutronic facilitate a de-icing function in feedback mode that makes it possible to heat the modules. Solutronic shall accept no liability for consequential damage to cables, wiring, buildings, PV modules or their mounting frames that arises from proper operation or non-operation of the de-icing function.	

If you need help do not hesitate to contact us.

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